APPLICATION OF MACHINE-TO-MACHINE COMMUNICATION IN HEALTHCARE SYSTEMS

Thesis submitted in partial fulfillment of the requirements for the degree

of

Bachelor of Technology

in

Electronics and Communication Engineering

By

KAUSTUV MISHRA
ROLL – 110EI0244 and
DIBYAJYOTI BEHERA
ROLL-110EC0158

Department of Electronics & Communication Engineering
National Institute of Technology
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Under the guidance of
Prof. Shrishailayya M. Hiremath

Department of Electronics & Communication Engineering
National Institute of Technology
Rourkela

2010-2014

CERTIFICATE

This is to certify that the thesis entitled, "**APPLICATION OF MACHINE-TO-MACHINE COMMUNICATION IN HEALTHCARE SYSTEMS**" submitted by **Kaustuv Mishra(110EI0244)** and **Dibyajyoti Behera(110EC0158)** in partial fulfillment of the requirements for the award of **Bachelor Of Technology** degree in **Electronics and Communication Engineering** during session 2010-2014 at National Institute of Technology, Rourkela (Deemed University) is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other university/institute for the award of any Degree or Diploma.

Date :

Place: Rourkela

Prof. Shrishailayya M. Hiremath

Dept. of Electronics & Communication Engineering

National Institute of Technology, Rourkela

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Dibyajyoti Behera(110EC0158)

Kaustuv Mishra(110EI0244)

CONTENTS

ABSTRACT

Machine-to-machine (M2M) communications are used to make successful connections between Internet world and physical frameworks. Related advances in the field of technology are used to finish essential understanding and learning of this new correspondence and networking system. Machine-to-machine (M2M) communications are picking up more popularity in wireless networks.

The main objective of this project is to establish a wireless communication between two machines using wireless networks.

The main aim is to create a complete prototype on machine to machine communication that combines both wired and wireless communication.

Thus, by using machine to machine communication, we can establish a connection between a heartbeat sensor connected to a patient's body and SERVER-PC. This would improve our present e-healthcare systems tremendously.

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ACRONYMS

M2M-Machine to machine communication

IP-Internet Protocol

LCD-Liquid Crystal Display

UART-Universal Asynchronous Receiver and Transmitter

SPI-Serial Peripheral Interface

GPIO-General Purpose Input Output

HDMI-High Definition Multimedia Interface

Chapter 1.

INTRODUCTION

1.1. Introduction

Machine to machine communication involves communication of machines by wire or wireless networks. The main purpose of introducing M2M communication is to reduce human intervention and achieve improved response time and better accuracy. Also by using M2M communication, we can achieve automatic control, which can be tremendously beneficial for many applications.

There have been tremendous advances in the field of information and communication technologies. One of the most pivotal applications of such advances is healthcare management. Medicinal services is moving from a methodology focused on responses to intense conditions to a proactive methodology described by prompt detection, counteractive action, and long haul management of well-being conditions. The current pattern puts an importance on the observation of health conditions and the administration of health as critical supporters to human services as also health. This is especially vital in modern nations with a critical maturing populace, where data engineering can altogether enhance the administration of interminable conditions and along these lines enhance personal satisfaction.

Specifically, the continuous or even infrequent recording of biomedical indicators is important for the diagnosis, detection and medication of cardiovascular ailments by utilizing remote wearable sensors. Case in point, persistent recording of an electrocardiogram (ECG) or photoplethysmogram (PPG) by a wearable sensor can give a sensible perspective of the heart state of a patient throughout typical day by day schedules, and can help catch such conditions as hypertension, anxiety, uneasiness, diabetes, and gloom. What's more, it is possible that further computerized dissection of recorded biomedical signs could help specialists in their everyday hones and permit the improvement of caution frameworks. This might bring a few profits: it might build the health perceptibility, cooperation around heath specialists, and doctor-to-patient productivity, and consequently diminish medicinal services costs. Additionally, such nonstop observing might build early recognition of anomalous wellbeing conditions and maladies, and hence give an incredible potential to enhance the personal satisfaction of patients.

Machine to machine (M2M) alludes to innovations that permit both wireless and wired frameworks to communicate with different gadgets of the same sort. M2M is a wide term as it doesn't pinpoint particular wireless or wired networking, information and communications innovation. This expansive term is especially valuable for business executives.

Present developments in M2M frameworks together with the ascent of M2M communications over wired and wireless connections permit the configuration of lightweight, low-control sensors at minimal effort for wearable sensor networks, integrated circuits, furthermore wireless communication. At its origin, the fate of M2M communication was indeterminate around then; designers were simply starting to figure out how to straightforwardly associate cell engineering to other workstation frameworks. Nonetheless, with the latest entrance of embedded gadgets, M2M communications turned into a predominant communication ideal model in numerous provisions that focus on information trade around machines to make these machines insightful in a restricted sense, furthermore around networked applications, whose centre is the insightful association of machines in a general sense.

M2M can incorporate the instance of modern instrumentation - containing a gadget, (for example, a sensor or meter) to catch an occasion, (for example, temperature, stock level, and so forth.) that is handed-off through a system (wireless, wired or hybrid) to a provision (software program) that makes an interpretation of the caught occasion into genuine data. Such communication was initially finished by having a remote system of machines hand-off data over to a focal centre for investigation, which might then be rerouted into a framework like a PC.

On the other hand, cutting edge M2M communication has stretched past a balanced-association and changed into an arrangement of networks that transmits information to particular machines. The extension of IP networks over the world has made it far simpler for M2M communication to happen and has decreased the measure of power and time vital for data to be conveyed between machines. These networks likewise permit a cluster of new business open doors and associations between buyers and makers as far as the items being sold.

M2M was originally used for automation and instrumentation but now has been also used to refer to telematics applications.

As a prime profit of these new systems, IP-based wireless networks have been an impetus for quickened advancement in M2M administrations, as they have aided in the recognizable proof of concealed development opportunities in M2M administrations.

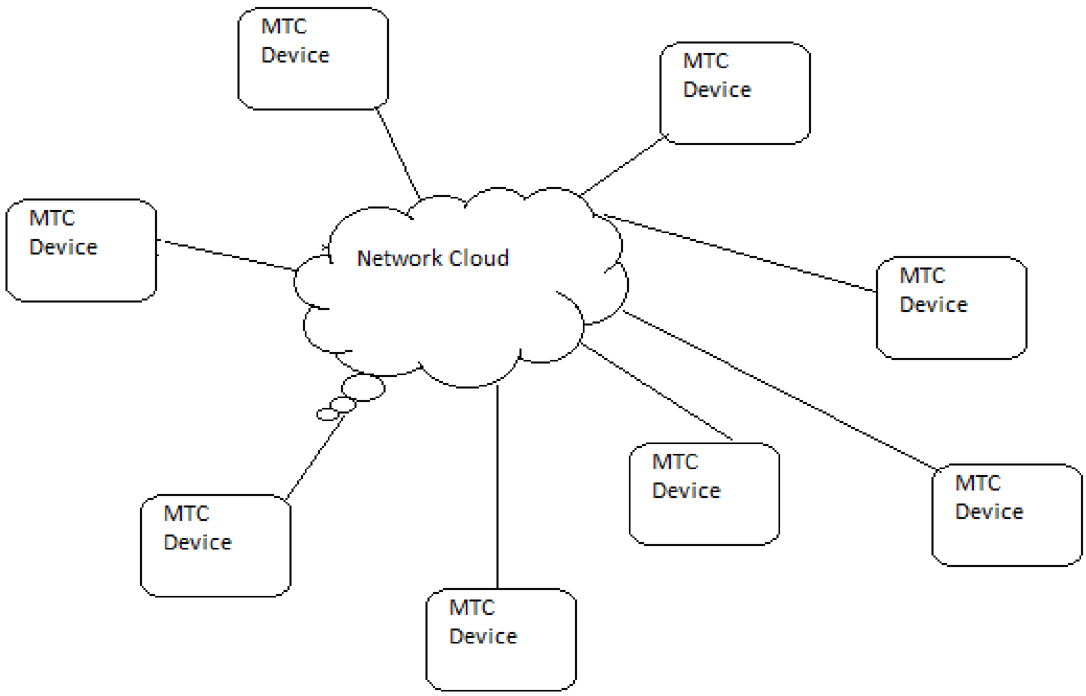


Fig1.1 General Machine-to-Machine Communication

The above figure shows a general model for setting up a machine-to-machine communication network. Data can be transmitted using the network cloud from one point to another.

1.2. General M2M Device Model

The construction modelling of M2M framework could be categorised into three layers: device-layer, communication-system -layer and business-layer. They represent sensor-system, transmission-system and application system autonomously. M2M device-layer is the centre hardware in the M2M framework, and is essentially answerable for getting the obliged information from the particular recognized question and undertaking information gathering in a sensor networks.

All in all, there are three primary parts in M2m devices: data-extracting-module, M2M-platform-module and business-giving-module. Data-extracting-module holds different sorts of sensors, and uses helpful data by the sensors. At that point the data is handled and transmitted to the M2M-platform-module; M2M-platform-module has powerful information breaking down and preparing capacity, and additionally could speak with distinctive M2M terminals, the control focus and indeed the centre communication system. Also, it has a mixture of interfaces of distinctive businesses, so it could benefit an arrangement to send the message to the destination; as per the message that from the M2M-platform-module, the principle undertaking of the business-giving-module is doing information examination further and giving information help for the particular business.

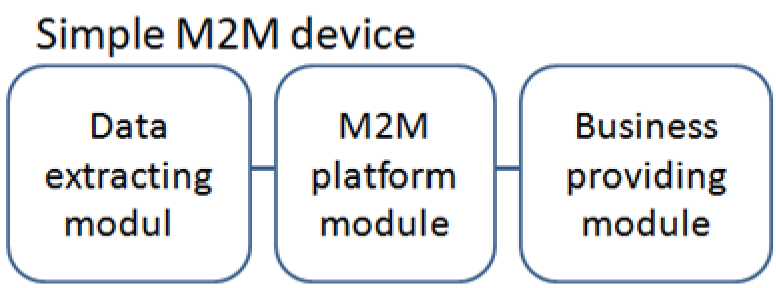


Fig 1.2 A simple M2M Device Model

As per the meaning of Internet of Things, the M2m devices ought to have the accompanying essential capacities:

- The data recipient
- Information transmission channel
- Storage function
- The Cpu
- The operating system
- Special provisions
- Information transmitter

So, the following general M2M model is used :

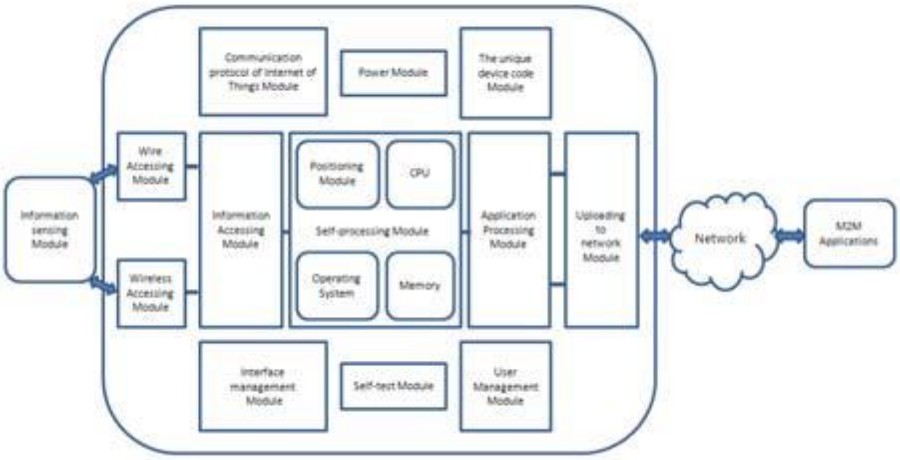


Fig 1.3 General M2M Device Model

1.3. Applications Of M2M Communication

- ✓ **Traffic control systems:** Traffic control is an area of concern that can gain from M2M communications. In a run of the mill system, sensors screen variables, for example, traffic volume and rate. The sensors send this data to machines utilizing specific programming that controls traffic-control equipment, in the same way as lights and variable educational signs. Utilizing the approaching information, the product controls the movement control devices to augment traffic stream.

- ✓ **e-Healthcare systems:** Enhances health specialists to patient communication. This expands the well-being perceptibility ,cooperation around the specialists and accordingly diminishing the medicinal services cost. Additionally such checking might build the early location of the unusual well-being conditions and ailments and accordingly giving an incredible potential to enhance the nature of the life of the patients.

- ✓ **Disaster Management:** Machine to Machine communication could be adequately utilized as a part of the administration of debacles by its initial recognition.

In addition to these applications, there are a numerous other applications of M2M communication in the present scenario that can benefit the quality of work life as well as personal life tremendously.

1.4. Objective of the Project

The main aim is to create a complete prototype on machine to machine to machine communication that combines both the wires and wireless communication.

This project serves to a specific case as stated below:

Suppose a patient is prone to heart attack. Then, his body/health parameters have to be monitored continuously for effective diagnosis and treatment. In case, he is not in a hospital or he may be at his home. Then, his heart rate measured by a heartbeat sensor which is connected to the body of the patient can be transmitted from this sensor to a machine (microcontroller) which processes this information and gives meaningful output which can be then displayed on a LCD screen or can be used to sound an alarm system for notifying the responsible people.

There are two parts to the the mentioned projects.
1-Hardware extensions
2-Software Applications

The hardware has been implemented by establishing a wireless connection between two machines. In this the two machines happen to be a Raspberry PI and a server PC, and the sensor to be a temperature sensor LM35.

Then, we have used a microcontroller and heartbeat sensor. The data obtained from a heart beat sensor has been transmitted through a wireless channel using a RF trans-receiver and the data obtained from the RF receiver has been processed using 8051/52 microcontroller and the final output has been displayed by a LCD display.

1.5. Thesis Overview

The thesis can be broadly divided into four chapters:-

Chapter 2- Overview of the Components Used: This chapter gives us an impression about the different components that are used for completion of the project. We get an idea about the heartbeat sensor, 8051 microcontroller, LCD display, RF trans-receiver, raspberry-PI processor etc.

Chapter 3- System Design: This chapter explains about the architecture and interfacing of the devices being used.

Chapter 4- Results and Discussion: This chapter describes the output and results obtained.

Chapter 5- Conclusion and Future Scope: This chapter draws the conclusion from the project and also gives us an idea about the future prospects that can be implemented.

CHAPTER 2
OVERVIEW OF COMPONENTS USED

2. Components Used

The following devices have been effectively used for our project.

- Raspberry PI Processor
- Heartbeat Sensor
- RF Trans-receiver(R433A)
- 8051 microcontroller
- 16*2 LCD Display(JHD 162A)
- 8051 Developer kit(MikroEleektronika)
- Buzzer(optional)
- Proteus 8 Professional(for simulation)
- Keil microvision4(for debugging)
- 7805 Voltage regulator series

2.1. Raspberry Pi Processor

Fig 2.1 Raspberry PI [9]

The Raspberry Pi is a credit card sized single board computer. It was developed by the Raspberry PI foundation in the UK to promote education in schools.

The features and components of Raspberry PI are as follows:

- Broadcom BCM8235 processor. It is a SOC(system-on-a chip) type processor and also includes an ARM 700 MHz processor
- 256 megabytes of RAM. This was later upgrades to 512 MB
- Uses a SD card for booting and storage
- Contains USB ports, one HDMI (High Definition Multimedia Interface) port and audio and video jacks

2.1.1 Pin Layout

The raspberry Pi has 26 pins on it to empower outside interchanges through its pins. They are available in two columns of 13 pins each.

Along with the well-known USB, Ethernet and HDMI ports, the Raspberry-Pi offers more level-level interfaces expected to unite all the more straightforwardly with chips and subsystem modules. These GPIO (general purpose I/O) motions on the header pins incorporate SPI, I2c, serial UART, 3v3 and 5v power.

The behaviour of the GPIO pins can be regulated by software (MATLAB in our case) which is present on the SERVER-PC.

Fig 2.2 Pin Layout of Raspberry PI [9]

2.2 HEARTBEAT SENSOR:-

The model of the heartbeat sensor which is used in this project is GLTS HBS 001.

Working principle:-

Heart beat sensor is designed to give digital waveform of the heat beat when a finger is placed on in between the IR transmitter and receiver. When the heart- beat detector is working condition, the beat LED flashes each time in unison with the heart beat. This digital output can also connected to a microcontroller to calculate the Beats Per Minute (BPM) rate. During the compression of the heart, blood pumps towards the end of the finger, so the density of blood increases, as a consequence the intensity of the light that is being received by the IR receiver decreases, so corresponding a low signal is obtained. Similarly in the time of expansion a high amplitude signal is obtained. This analog signal is passed through an OP-AMP which is being used as a comparator. By carefully setting the proper reference voltage of the op-amp a square pulse is generated, as shown in the figure.

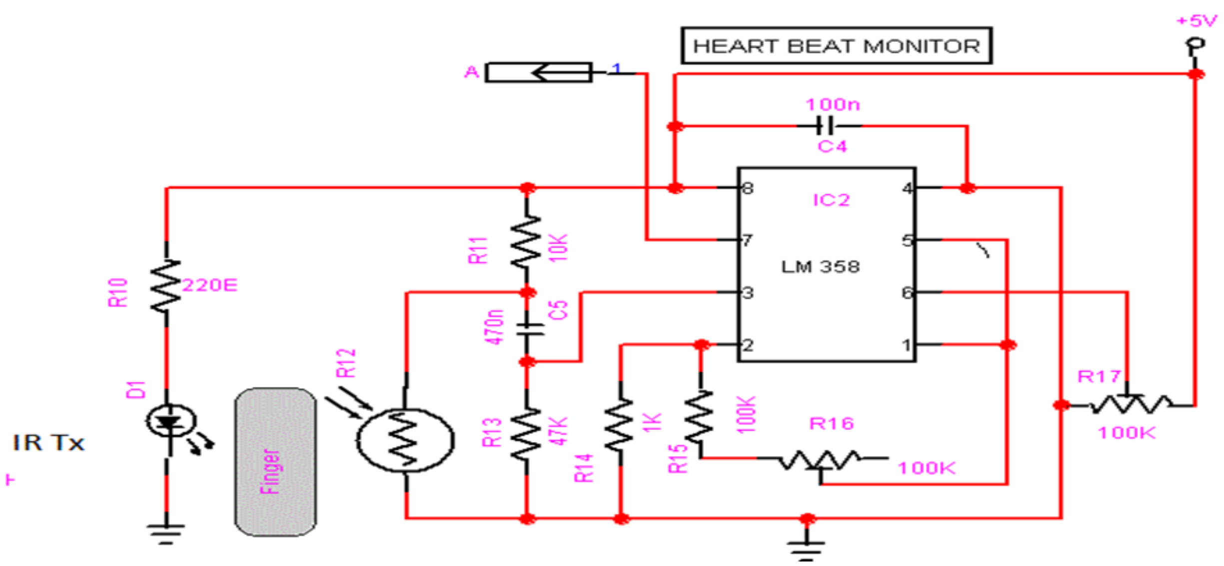


Fig 2.3 Circuit diagram for GLTS HBS 001

2.2.1 Specifications:

Table 2.1

Operating voltage	+5V DC
Operating current	150 mA
Output data	5v TTL
Detection of heartbeat	LED indication
Source of light	660nm super LED

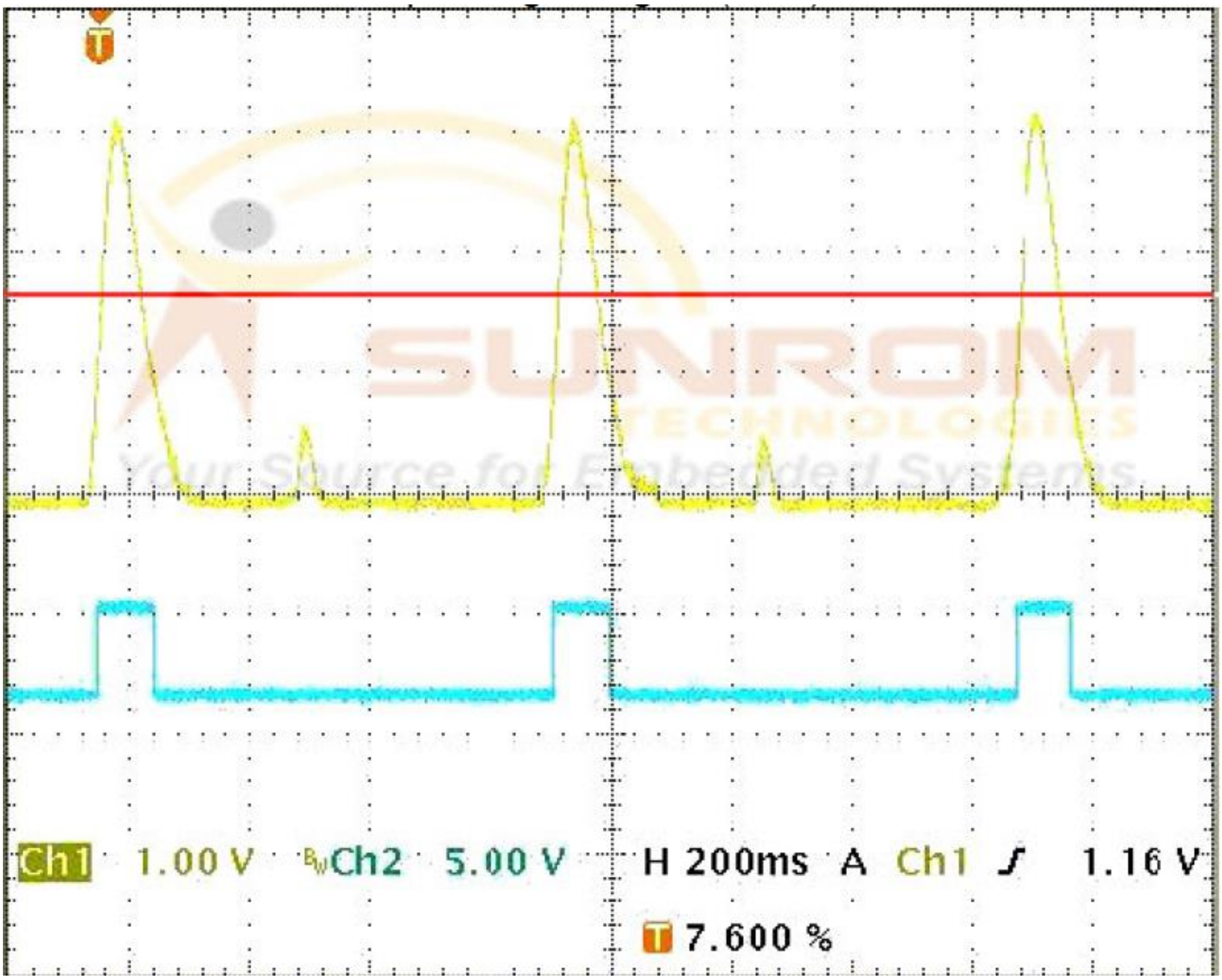


Fig 2.4 Analog and digital output waveform of heartbeat sensor

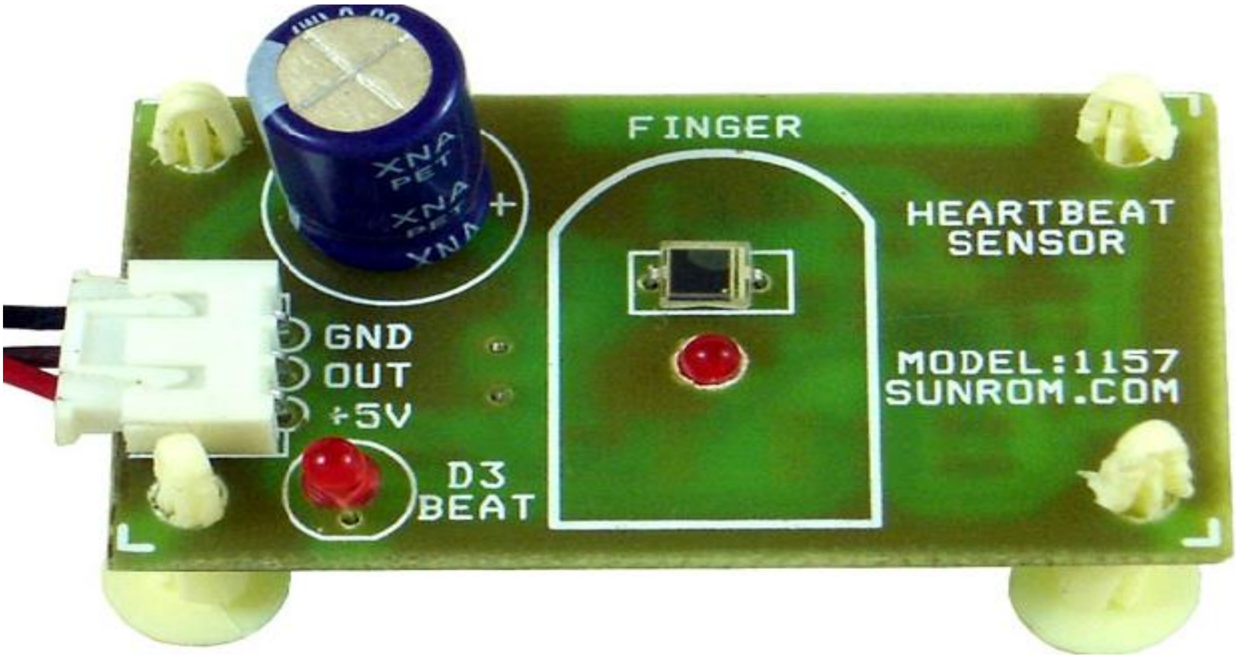


Fig 2.5 Heart beat sensor

2.2.2. FEATURES:-

- High beat LED indication
- Instant output digital signal
- Compact in size
- +5V working voltage

2.3. RF Module:-

- The RF module used in this project is R433A,which operates at a frequeny 433MHz.

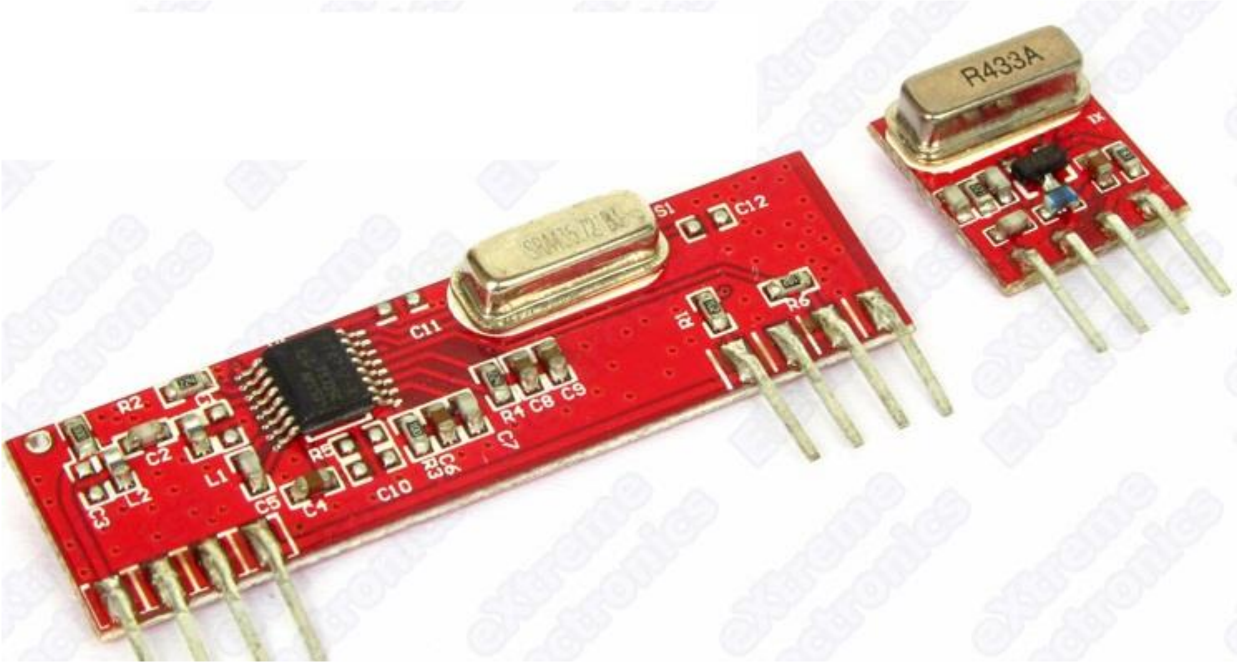


Fig 2.6 R433A RF module

2.3.1. Pin Configuration:-

RF Transmitter-

Pin No.	Name	Function
1	GND	Ground (0V)
2	DATA	Serial Data Input
3	Vcc	Supply Voltage (5V)
4	ANT	Antenna Output

Table 2.2

- RF receiver-

Pin No.	Name	Function
1	GND	Ground (0V)
2	DATA	Serial Data Output
3	NC	No Connection
4	Vcc	Supply Voltage (5V)
5	Vcc	Supply Voltage (5V)
6	GND	Ground (0V)
7	GND	Ground (0V)
8	ANT	Antenna Input

Table 2.3

2.3.2. Working principle:-

A RF module is normally an electronic gadget used for transmitting and receiving the radio signals between two gadgets. In Embedded systems, it is necessary to communicate with an alternate gadget remotely. This wireless communication may be done through Radio Frequency (RF) communication or Optical communication. For some provisions the medium of choice is RF since it doesn't need a line of sight.

The signal to be transmitted is fed through the DATA pin of the RF Tx named "DATA".This signal get transmitted to the destination through the wireless channel at a carrier frequency of 433MHz.The signal then received at the receiving stage has been processed for further operation accoring to the project.

2.3.3. RF Modulation:-

This are the common types of signal modulation that are being used in RF transmission and reception.

- ASK
- FSK
- OOK
- Frequency Hopping spread Spectrum
- Direct sequence spread spectrum

1. **ASK:-**

   Amplitude-shift keying (ASK) is an amplitude modulation in which that digital data is represented as change in the amplitude of the carrier wave. In the ASK system, the binary symbol '1' is represented by transmitting a fixed-amplitude carrier signal and fixed frequency for a bit time of T seconds. When the signal value is 1 then there will be transmission of the carrier signal; otherwise, if the signal value is 0,then the carrier wave will not be transmitted.

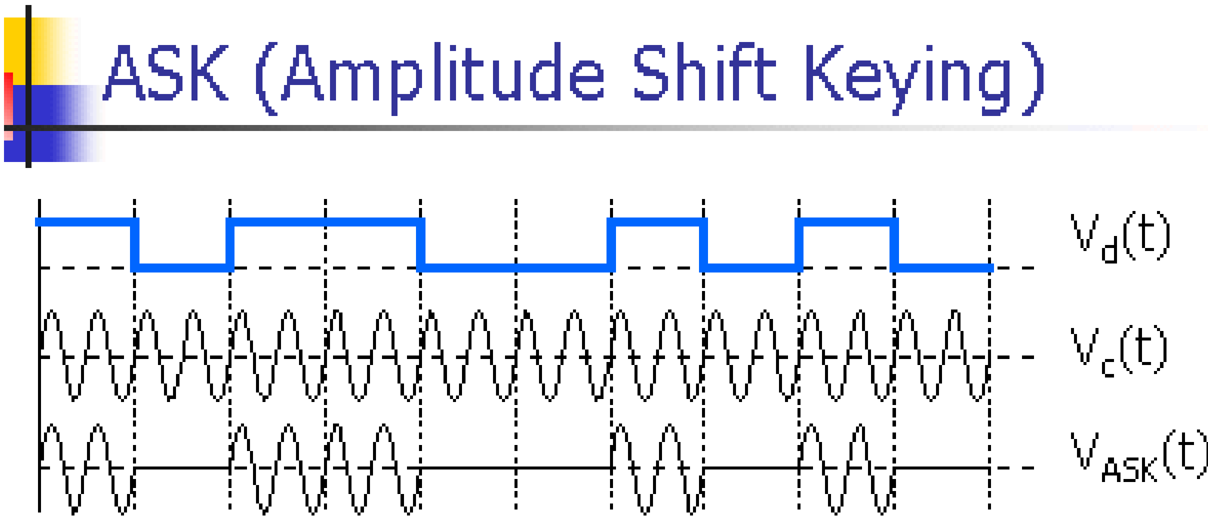


Fig 2.7 Amplitude Shift Keying

FSK:-

Frequency shift keying (FSK) is a modulation in which digital signal is transmitted through discrete frequency variations of the carrier signal. The simplest form of FSK is **binary FSK** (**BFSK**). BFSK uses a pair of discrete frequencies to transmit the binary information. In this modulation, the "1" is represented as the mark frequency and the "0" is represented as the space frequency.

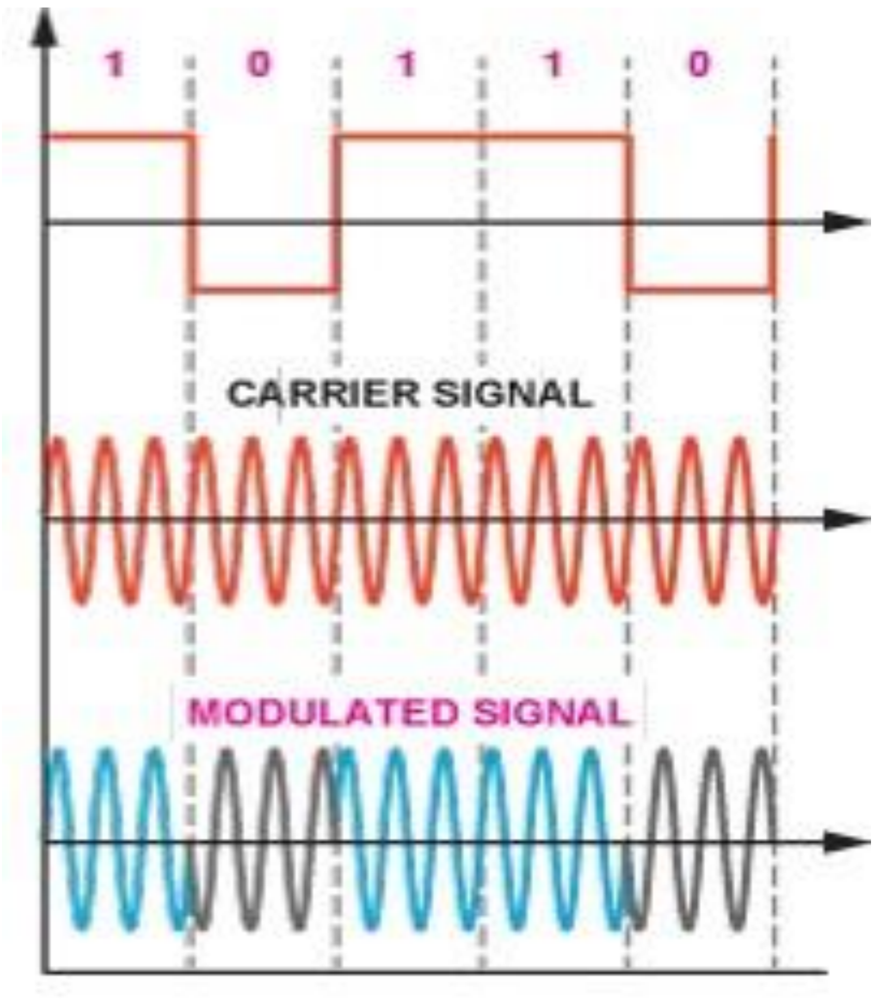


Fig 2.8 Signal representation of the FSK modulation

2.4. 8051 Microcontroller:-

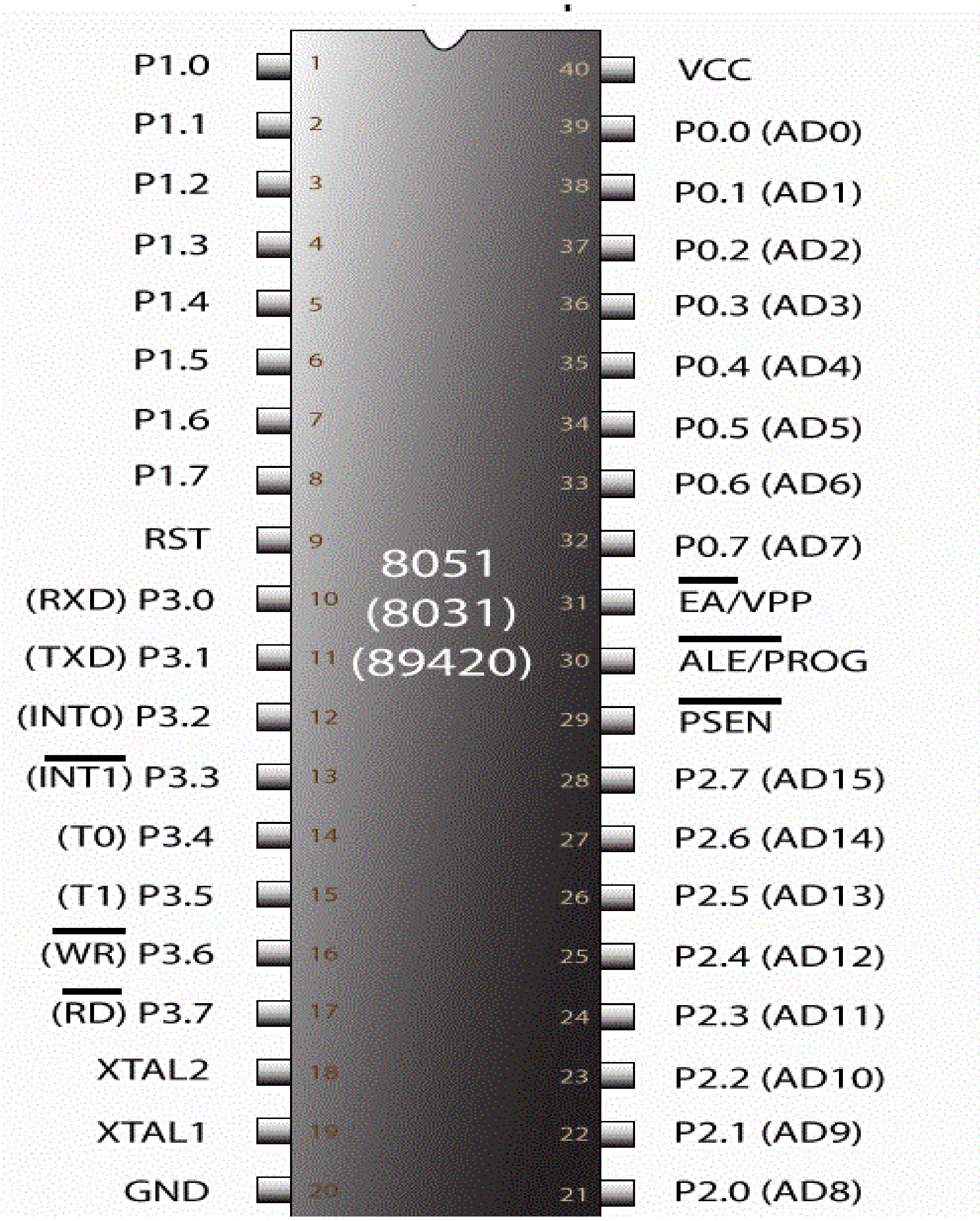


Fig 2.9 Pin Layout

The Intel 8051 uC series is a Harvard architecture, CISC processor, single on-chip microcontroller series which was developed by Intel in 1980 for extensive use in embedded systems.

2.4.1. Features of 8051 series:-

- 8-bit ALU unit and an Accumulator, 8-bit Registers banks), 8-bit data bus.
- Simple processor with 17 instructions, 1-bit accumulator, 32 registers and 144 special 1 bit-addressable RAM memory locations.
- Multiplication, division and compare instruction sets.
- 4 fast register banks with memory mapped 8 registers .
- Fast interrupt with optional register bank switching
- Interrupts with predefined priority rules.
- Dual 16-bit address bus , 2 x 2^{16} memory locations can be accessible ,64 Kb each of ROM and RAM.
- on-chip RAM -128 bytes
- 4 Kb ROM, with a 16-bit address bank (PMEM).
- 4 8-bit bi-directional I/O ports.
- UART in serial communication
- Two Very effective 16-bit Counter/timers, Timer 0 and Timer 1.
- Power saver mode

2.4.2. Architecture of 8051:

- Crystal clock
- Port configuration
- Internal Interrupt Structure
- Timers and counters
- Memory and Register Banks

2.4.3. Memory Organisation:-

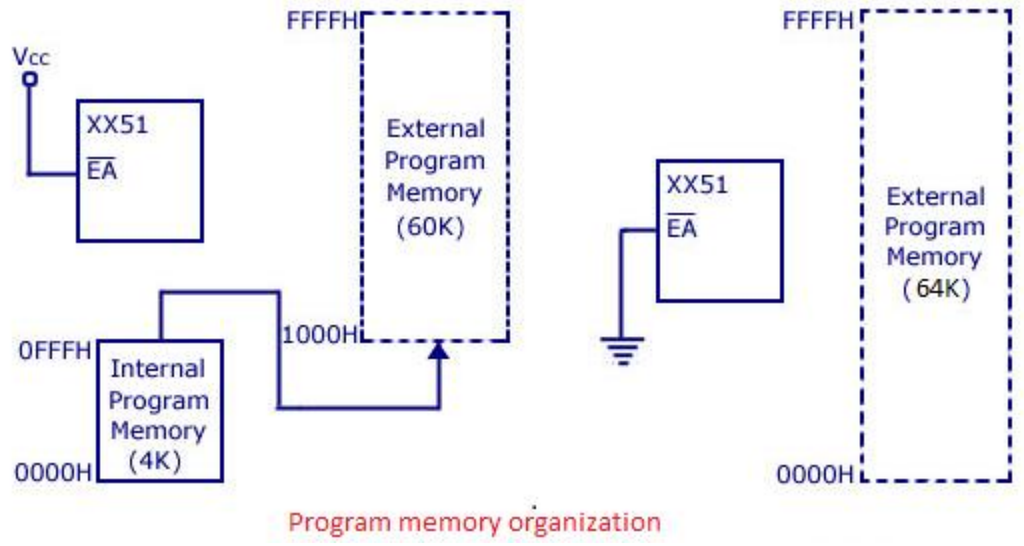


Fig 2.10 Memory organisation of 8051 microcontroller

The memory organization for 8051 series is as shown in fig. above. 8051 microcontroller consists of an on chip internal ROM of 4K size and whwnever necessary , we can add an external memory of size 60K.so total o f 64K memory is available for 8051 uC. By default, the External Access (EA) pin is connected Vcc.Initially the instructions are fetched from internal memory. When the internal limit of memory (4K) is crossed , control of program will be automatically shifted to external memory and remaining instructions will be fetched from external ROM. If only external memory is needed i.e. to fetch instruction from external memory,then we have to connect External Access (EA) pin to ground as shown in fig. above.

Crystal clock:-

The 8051 requires an external crystal oscillator circuit. The oscillator circuit operates on 12MHz, although the 8051 has capability of running at a maximum of 40MHz. Each machine cycle in the 8051 uC is of 12 clock cycles, giving an cycle rate at 1MHz (for 12MHz clock) to 3.33MHz (for maximum 40MHz clock). The oscillator circuit generates the clock signals so that all the internal operations can be properly synchronised.

Port configuration:-

Pins 1-8: Port 1 can be configured as an input or an output.

Pin 9: RS A logic '1' on this pin disables the microcontroller and resets the contents of most registers.. By applying logic 0 to this pin, the program will begin the execution.

Pins10-17: Port 3 , each of these pins serves as general purposei nput or output. Besides, all of them have special functions:

Pin 10: RXD,used for Serial asynchronous communication input and Serial synchronous communication output.

Pin 11: TXD Serial asynchronous communication output or Serial synchronous communication clock output.

Pin 12: INT0 input of Interrupt 0.

Pin 13: INT1 Interrupt 1 input.

Pin 14: T0 Counter 0 input.

Pin 15: T1 Counter 1 input.

Pin 16: WR Write to the external RAM.

Pin 17: RD Read from the external RAM.

Timers and Counters:-

Many microcontroller requires the count of external events, such as the frequency of a pulse sequence, or the generation of exact internal time delays between computer activities. This can be accomplished using software techniques, but software for counting or timing occupies the processorfor a substantial amount of time, perhaps more important, functions are not executed. To get rid of this burden, two 16-bit up counters, named T0 and T1, are embedded for the general use of the programmer. Each counter can be programmed for counting internal clock pulses, as a timer, or programmed to count the external signals as a counter.

Timer is set by an 8 bit register commonly known as TMOD register.

gate	c/t	M1	M0	Gate	c/t	M1	M0

- **GATE**-This bit is required for manually ON and OFF the timer through hardware.
- **C/T**-logic 1 on this implies The timer to be used as a counter and a logic 0 implies the timer to be used a timer for delay generation.
- **M1,MO**:-this two bits determines the mode on whichthe timer or the counter to be operated.

  The 1^{st} 4 bits are effectively used for Timer 1 and the lower 4 bits are used for Timer 0.

2.5. 8051 Developer kit(MikroElektronika):-

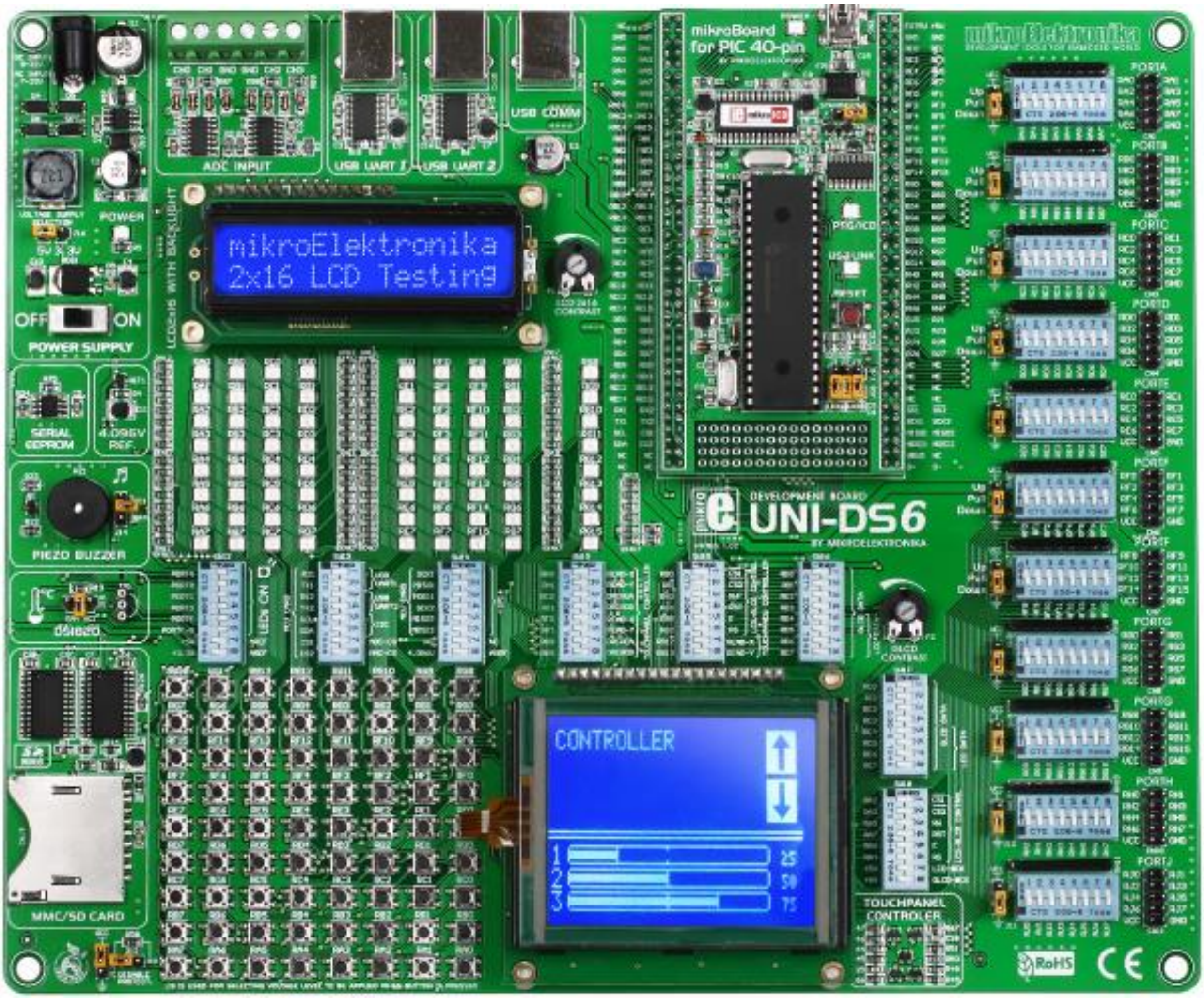


Fig 2.11 8051 Developer Kit

- **Easy8051 v6** development system is supported by a huge range of **Atmel 8051** microcontrollers.
- Fast, on-board **USB 2.0 programmer** with a simple driver installation procedure.

- **Serial COG Display** which uses SPI interface is available for displayof the text messages.
- **Easy8051 v6** allows 8051 microcontrollers to interface with variety of peripheral devices. The uC model used is **AT89S8253.**
- On-board 16-bit I/O **port expander** MCP23S17 that uses SPI communication.
- **7-segment displays** in multiplexing mode are connected to the uC socket.
- All pins connected to the **IDC10 connectors** for further extension.
- 38 **LEDs** are used for the indication of the logic state of all microcontroller pin.
- **Graphic LCD 128x64** can be easily interfaced through the on-board connector.
- **GLCD Contrast Potentiometer** is used for the adjustment of graphical LCD contrast.
- All of the MCU **pins** are painted on the back of the kit. These marks provide basic knowledge of the pins.
- Fast, on-board **USB 2.0 programmer**. There is no requirement for connection to the external programmer

2.6. 16*2 LCD display:-

The model of LCD used is JHD 162A.

ALCD is an even board, electronic visual showcase which utilizes the property of light modulation of fluid crystals. Light cant be specifically emiited by fluid crystal. The working of LCD rely on upon two sheets of polarizing material with a fluid crystal result amidst them. At the point when an electric current is passed through the fluid, it causes the crystals to adjust so it closes out light and does not permit it to pass[10]. Every crystal carries on like a screen, it either permits light to pass through or obstructs the light..

It can work legitimately in the temperature reach of -10°C to 60°C and has working lifetime of longer than 50000 hours (at room temperature without immediate irradiation of daylight.

Fig 2.12 LCD Display

LCD Block diagram:-

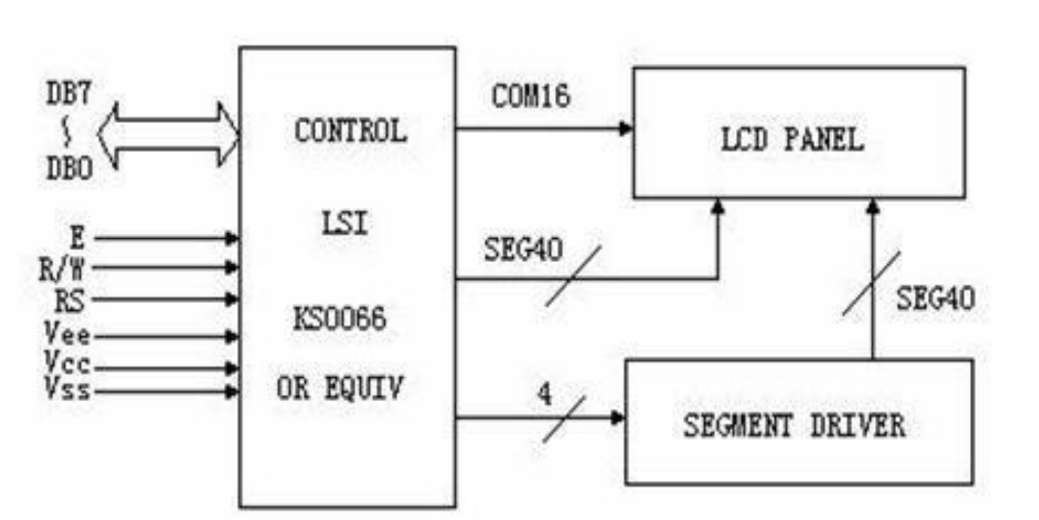


Fig 2.13 LCD Block Diagram

2.6.1. LCD Pin Configuration:-

Table 2.4

PIN NO.	SYMBOL	DESCRIPTION	FUNCTION
1	VSS	GROUND	0V (GND)
2	VCC	POWER SUPPLY FOR LOGIC CIRCUIT	+5V DC supply
3	VEE	LCD CONTRAST	
4	RS	INSTRUCTION/DATA	RS = 0 : Command register
5	R/W	READ/WRITE SELECTION	R/W = 0 : Write to the registers
6	E	ENABLE	High to low pulse
7	DB0		
8	DB1		
9	DB2		
10	DB3		
11	DB4		
12	DB5		
13	DB6		
14	DB7	DATA INPUT/OUTPUT	8 BIT: DB0-DB7
15	LED+	SUPPLY VOLTAGE LCD Backlight	+5V

CHAPTER 3

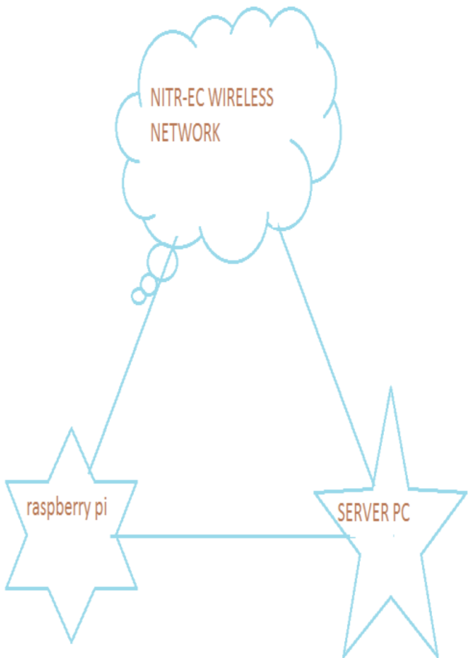
SYSTEM DESIGN

3. SYSTEM DESIGN

Here, we have first implemented a system using a Raspberry- PI processor.

3.1. Using Raspberry PI

We have successfully established both wired and wireless communication between a Raspberry PI processor board and a SERVER-PC (which in this case is a laptop) using NITR-EC wireless network present in the laboratory



The data from sensor is first given to the Raspberry-PI processor using GPIO pins. Then, a successful connection is established between the Raspberry-PI and the SERVER-PC through NITR-EC wireless network using MATLAB. Firstly, an object is created in MATLAB and then connection is established by the use of following commands:

```
a=raspberrypi;

a.connect;
```

3.2. System Design Using 8051 Microcontroller:-

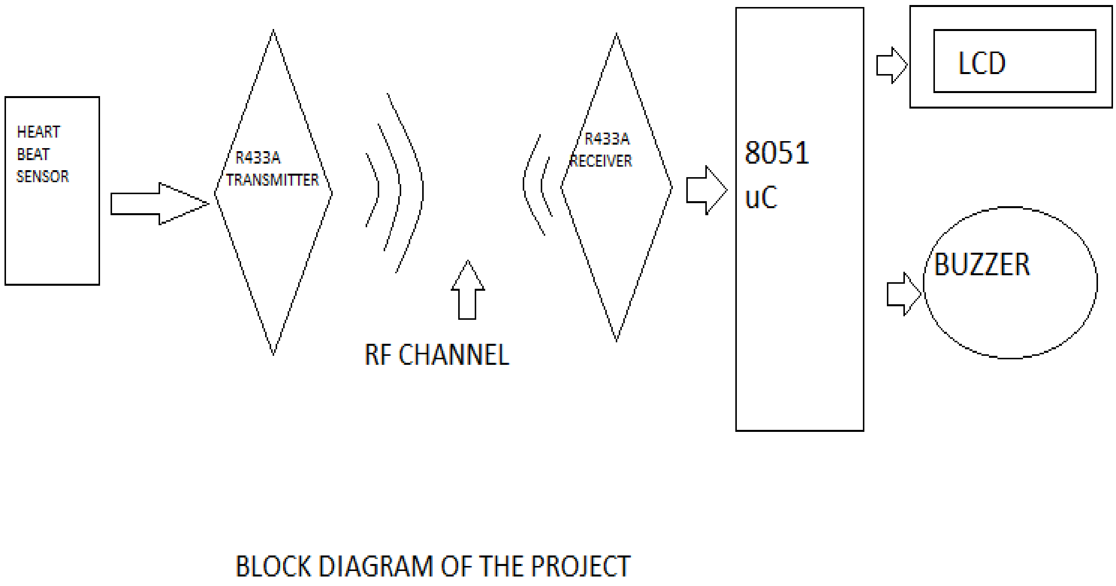


Fig 3.1

3.2.1 Overall Functioning:-

First the communication between the human body and the heart beat sensor is established. The completed working procedure of the heart beat sensor is explained in the next section. According to the way the heart beats in the body, a square wave pulse is obtained from the heart beat sensor. The square pulse is nothing but a characteristic pulse with respect to the heartbeat. As the project is closely concerned with the health care system, it is highly essential to synthesize a genuine procedure to use this signal that is coming out of the human body in the field of medical application. So the signal has been transmitted to some distant place using RF communication, because the main objective of our project is to let the people around the patient know about the real time condition of the patient and this is only possible if the signal from the body through the heartbeat sensor is effectively transmitted to the distant location where the concerned people are present.

In this way some life threatening accidents can be avoided by providing real time medical attention to the patient(prone to heart attacks, cardio vascular diseases) in case of emergency situation . For that, an RF wireless channel has been established using an RF trans-receiver. Since he signal that is being transmitted through the RF channel contains the information about the heart rate of the patient's body, it is essential to keep track of this signal in real-time. For this purpose, an 8051 microcontroller is used.

The basic purpose of the micro controller is to count the pulses that are being received through the RF channel in real-time and after a certain interval(which is user defined) it compares the counted value with the threshold value. In this case the threshold value is defined as the maximum/minimum heart rate that a human body can sustain without causing any substantial health hazards. If the counted value is greater than the threshold value ,then an ALERT message is sent. In this project the alert message is displayed through an LCD display , which continuously displays appropriate message that has been programmed by the 8051 microcontroller.

3.2.2 Interfacing The heartbeat sensor with the body:-

For interfacing the Heart beat sensor,First the finger is inserted in between the IR transmitter and receiver.The output signal obtained from sensor,is then passed towards the OP Amp which is being used as acomparator.And a digital square wave pulse is obtained according to the way the heart of the human beats.

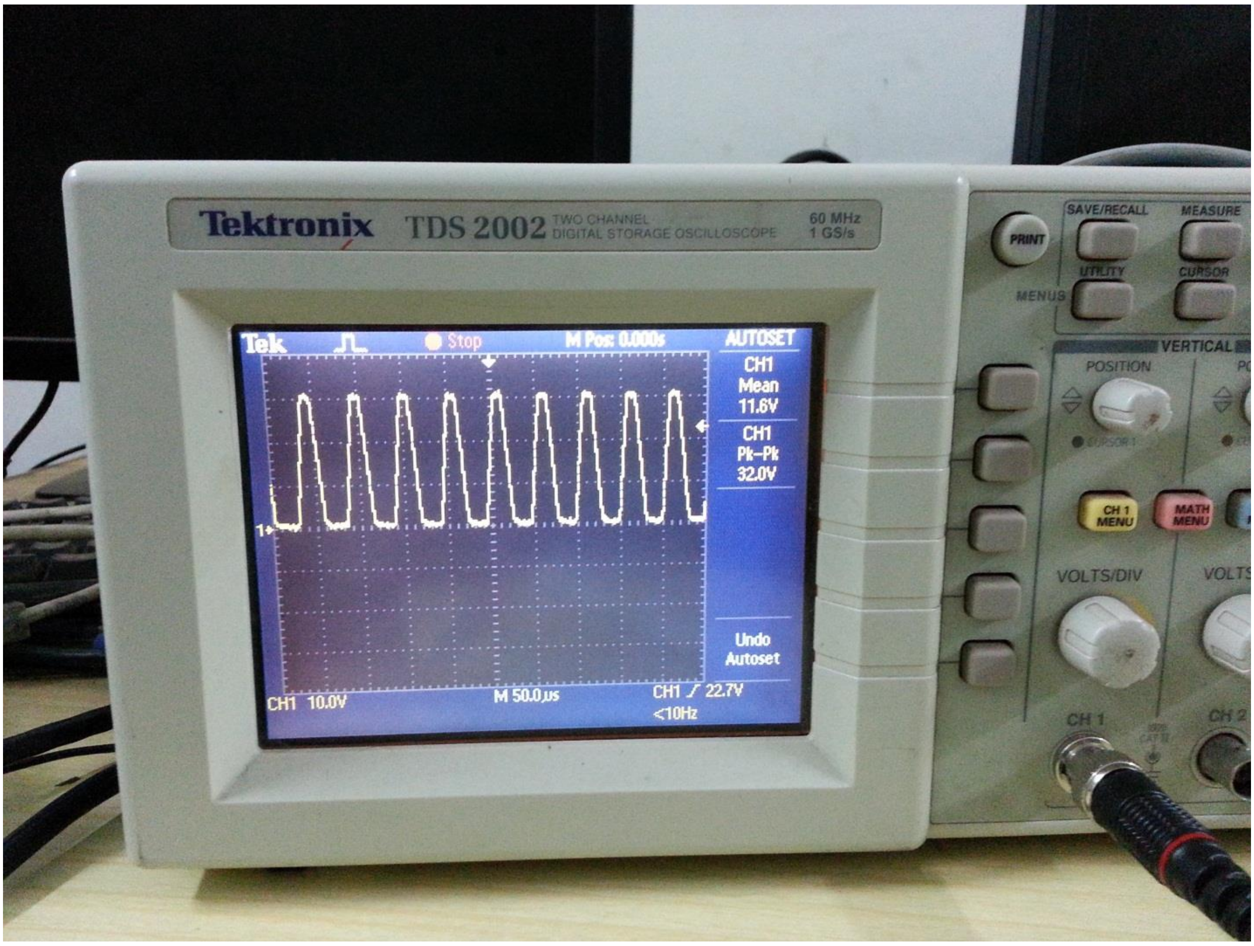


Fig 3.2 Digital Ouput From the Heart Beat Sensor

3.2.3. Interfacing The Heart Beat Sensor with the RF Transmitter:-

The signal thus obtained,as shown in the figure,is passed to the the “DATA” pin of the RF Transmitter.In the Antenna Terminal,a 10-15 long metal wire is established for the purpose of RF transmission.For testing Purpose,3 types of signals is tranmitted.

- A constant logic High Voltage
- A square wave pulse,+5V DC,varibale frequency
- The output of the Heart beat sensor

The +5V DC supply is provided through the Function Generator in the lab.In this way a systematic approach has been made towards the execution of the Final year Project.

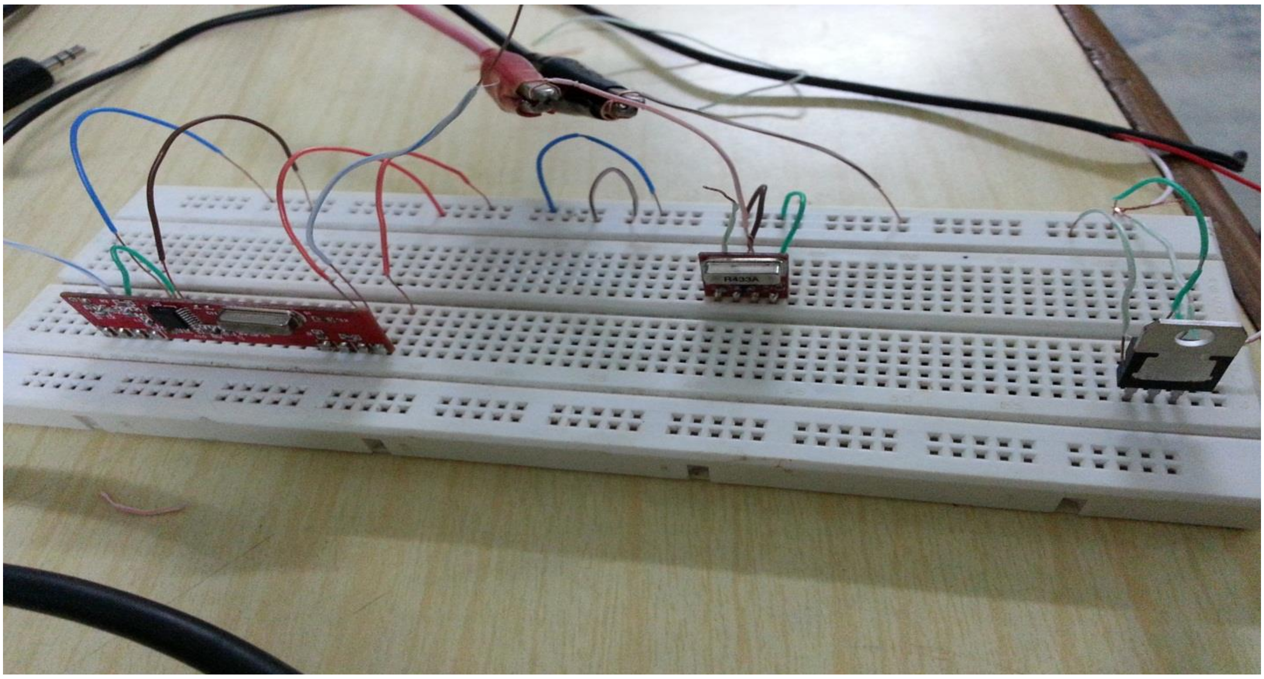


Fig 3.3 R433A RF module

3.2.4. Communication in between RF transmitter and RF Receiving stage:-

The signal which is transmitted by the RF Transmitter is received at the RF receiving stage through the RF channel.As already explained in the previous section,3 signals has been transmitted for the testing purpose.All the signals are effectively received and processed for further operation.The signals are received using ASK modulation,in which amplitude of the carrier signal changes according the logic 1′s and 0′s in the digital signal.The Amplitude and Frequency of the both transmitted and received signal are measured.The results of the following output are briefly explained in the previous section.

3.2.5.Interface in between the 8051 and the RF transmitter:-

The digital signal signal that is being received at the RF receiver,is the characteristic signal of the human heart rate.The number of pulses in the digital pulse train is exactly equal to the the number of times the heart beats.So to use this project effectively in human healthcare system,it is highly necessary that the number of pulses in the signal to be regularly counted in real time.For that purpose,the 8051 microcontroller is used.In this case,The TMOD register which determines the mode and type of timer circuit,is set to be 15H by settting the following expression.

TMOD=0x15;   (in embedded C language)

That means the 8051 uC to be operated in the Counter 0 mode 1 and Timer 1 mode 1 mode.The input to the counter 0 is given through the pin P3.4,which is the external counter output for Counter 0.In this case the P3.4 is connected to the RF receiving terminal through which the signal from the heartbeat sensor is received.The Basic job of Counter 1 is to give a certain time delay,within that period time the microcontroller counts the number of pulses.If the no of pulses after the time delay is less than the thresold value(maximum rate of heart beat that a human body can sustain without having a substancial health hazard),then the 8051 uC instructs the LCD to display a message that shows that the patient condition is normal,if it is more than the thresold then the 8051 instructs the LCD to display an alert message that has been programmmed by the 8051,to warn the the concerned people of the patient.In this the thresold value is assumed to be 80 BPM,where BPM stands for Beats Per Minute.So if the uC generates a delay of 10 secs,then the thresold value for that 10 secs is believed to be 80/6=14.Hence at the end of each Program cycle,the processor compares the counted value with 14 and correspondingly it generates the display.

3.2.6. Interface in between the LCD and the 8051 microcontroller:-

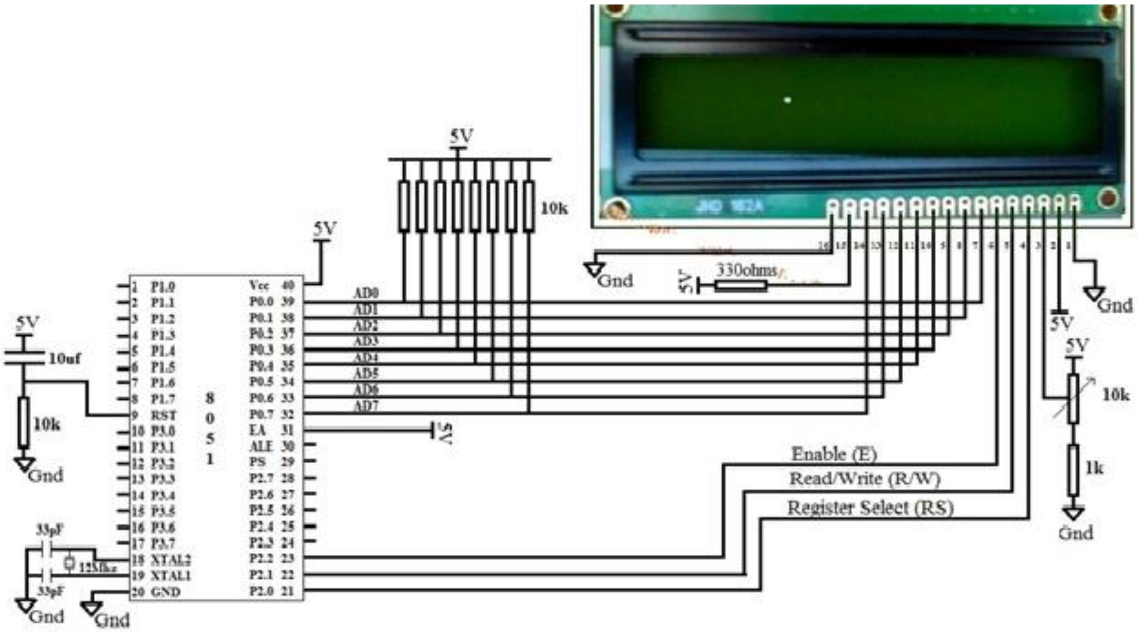


Fig 3.4 Interfacing between LCD and 8051

As shown in the diagram, the data pins of the LCD D0-D7 are connected to the Port 0.The RS pin is connected to the p2.0,the R/W pin is to the P2.1 and the EN pin to the pin P2.3.Normally a high to low pulse is given to the LCD for transfer of the data and command signals.The VCC,VSS and the VEE pins are connected as described in the previous sections.

3.3. SOFTWARE MODULE:-

The Stimulation which is used in the this project is PROTEUS 8 PROFESSIONAL and KEIL uVISION 4 for debugging.The follwing are the steps that are being used for the successful software level implementation of project.

- First a new project is created belonging the ATMEL 8051 series.
- Then in the LAYOUT page,an 8051 uC is placed by selecting it from the library,

- Then an appropiate LCD is selected from the Library package and the inteconnection are done according to the Circuit diagram as shown in the above figure.
- The program file which gets embedded on the 8051 uC,is created by the KEIL software and the corresponding HEX file is created by it.
- Then this HEX is loaded in to the 8051 in the LAYOUT page of the PROTEUS software and the desired output are obtained.

The complete diagram and the results are briefly explained in the next section.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 RESULTS AND DISCUSSION:-

The results and the output of the Project is systematically explained ,stage by stage,in the Following section.

4.1.1 Stage 1(Heart beat sensor):-

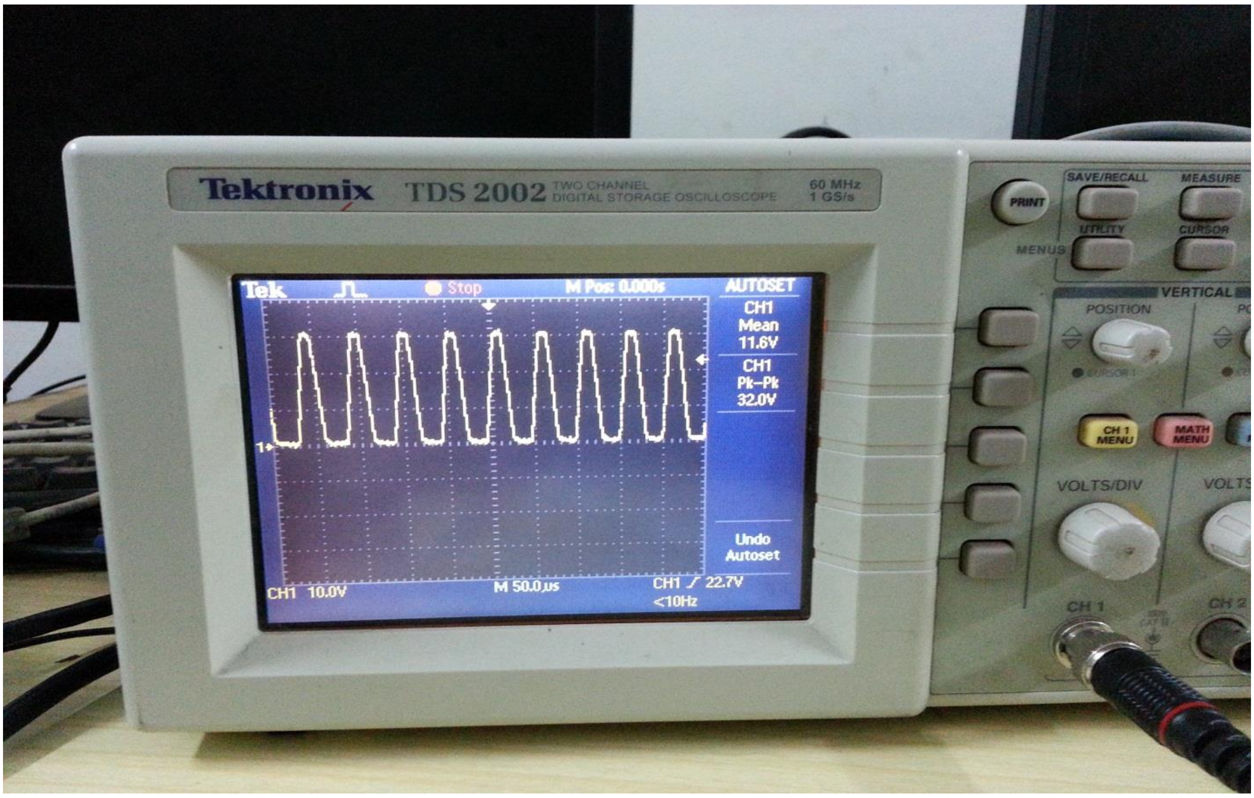


Fig 4.1 Heartbeat Sensor Output

The signal that is generated by the Heart Beat sensor is monitored by the Oscilloscope and its frequency is found to be less than 10,which is obvious.The number of pulses are exactly equal to the the number of times the human heart beats.

4.1.2 STAGE 2(RF Transmitter):-The output of the Heartbeat sensor is connected to the data pins of the RF transmitter.The output of the transmitter is tranmitted through the RF channel using ASK modulation.

4.1.3 STAGE 3(RF Receiver):-

The transmitted signal is effectively received by the RF reciever.The following are the outputs of the 3 test signal that are transmitted from RFTx.

1-Ideal Square wave pulse:-

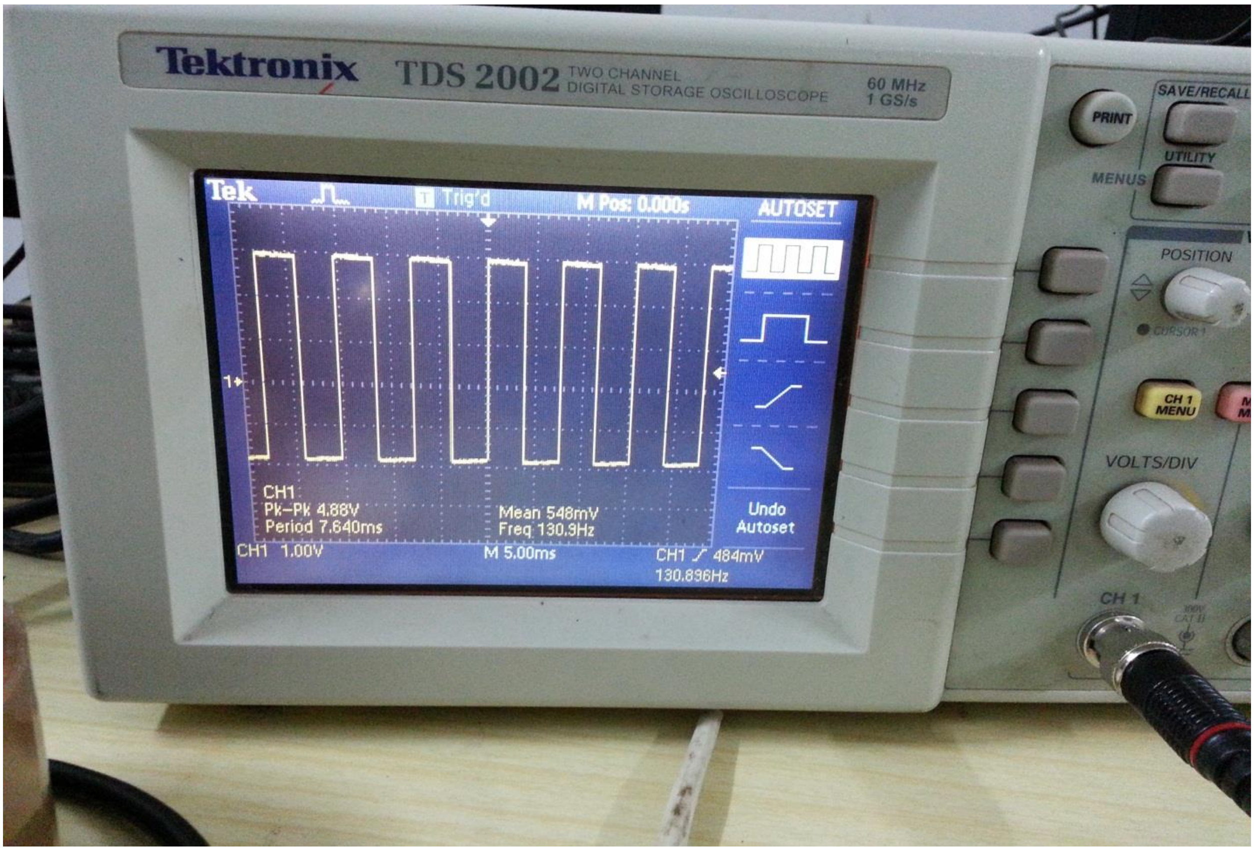


Fig 4.2 Ideal Square Wave Pulse Output

2-Pulses from Heart beat sensor:-

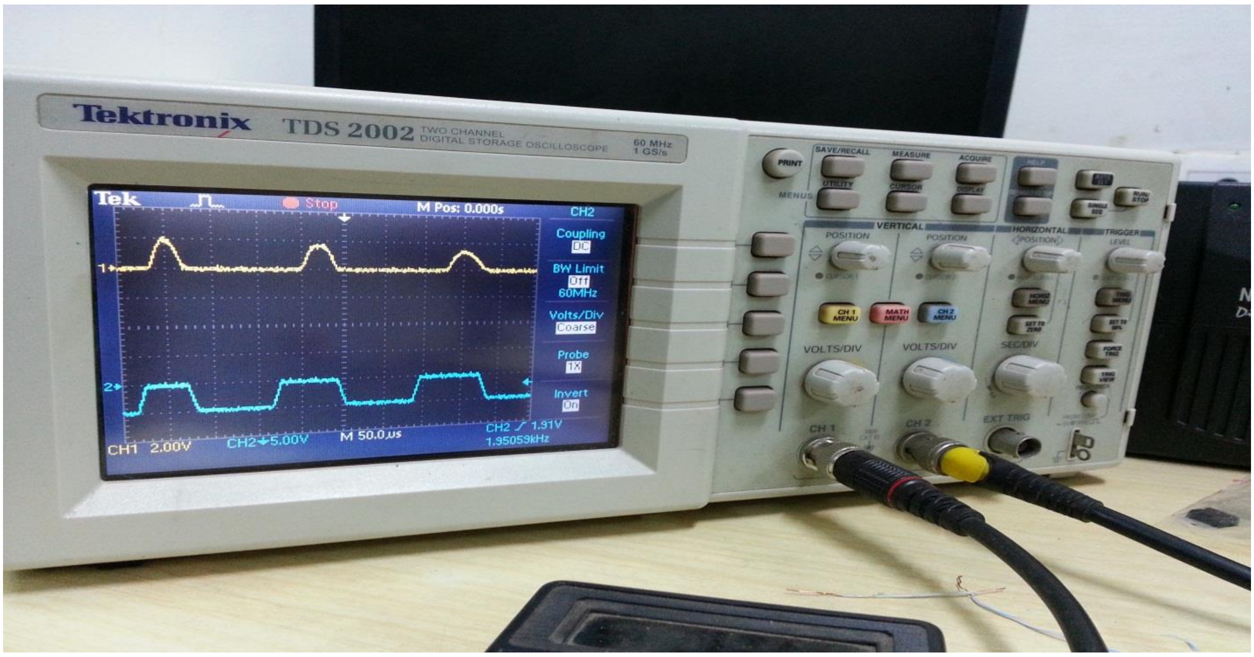


Fig 4.3 RF transmitter and receiver output

The signals in yellow colour represents the signal that is transmitted from the heartbeat sensor.

The signal in the green colour represents the the signal which is received at the RF receiving stage.

The frequency of the Receiver and the transmitter is exactly same.The error in the amplitude is +/- 5%.

4.1.4 STAGE 4(LCD Outputs):-

As per the number of pulses counted by the 8051 uC the LCD display messages accordingly.If the number is less than the thresold number,then the LCD displays the following message

Similarly if the number is greater the the thresold value the following output will be displayed.

FIG 4.4 LCD OUTPUT

The Schematic output of The PROTEUS 8 is as follows

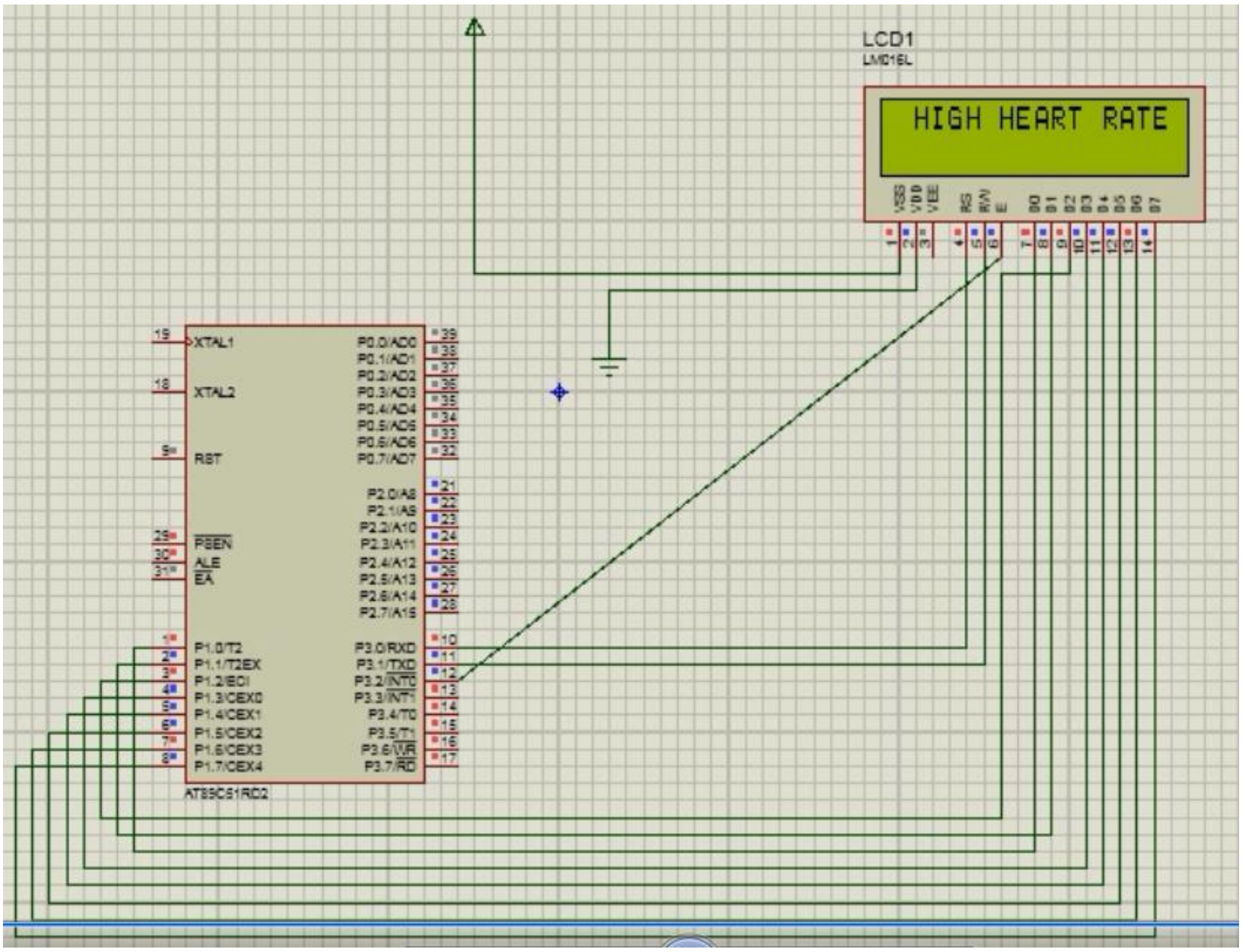


Fig 4.5 Schematic output of Proteas Software

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5. Conclusion

In this project, we have first successfully established both wired and wireless communication between two machines- a Raspberry PI processor board and a SERVER-PC.

Then, RF wireless communication was successfully established between the human body (heart beat sensor) and the 8051 microcontroller (machine).By doing so, we have implemented machine-to-machine communication successfully between two machines.

Then, we obtained data from a heart beat sensor and successfully transmitted the data to a microcontroller using a RF trans-receiver.The microcontroller processes the data to obtain meaningful information out of it.This, information is then displayed on a LCD screen and can be used to sound an alarm system.

By using M2M communication, we can reduce human efforts substantially and optimize the performance of machines.

Future Scope

Here, we have a used a heartbeat sensor that needs to be present with the patient as well as the system. So, the mobility of the patient is restricted as a result of this. To avoid this, a more sophisticated heartbeat sensor that can be attached to the patient's body with a strap or adhesive can be used and in that case, the heartbeat sensor also needs to have an in-built RF transmission system or Bluetooth system to transmit data to the microcontroller for further processing.

Again, the range of transmission is limited to around 50 meters. We can improve the range of this system by using a GSM module which can increase the range of this system manifold. In GSM module, it is feasible to transmit the data via mobile networks to cellular phones and devices and this improves the performance of the system and makes it more faster and reliable.

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